

**REFLECTIVE AND TRANSMISSIVE MODE MONOLITHIC MILLIMETER
WAVE ARRAY SYSTEM AND IN-LINE AMPLIFIER USING SAME**

REFERENCE TO RELATED APPLICATION

5

*E.A.
10-28-05*

This is a continuation in part of U.S. Patent Application Serial No. 10/153,140 filed 05/20/2002 by K. W. Brown *et al.*, and entitled "MONOLITHIC MILLIMETER WAVE REFLECTOR ARRAY SYSTEM" (Atty. Docket No. PD 01W176) the teachings of which are hereby incorporated herein by reference and from which priority is hereby claimed.

BACKGROUND OF THE INVENTION

15

Field of the Invention:

This invention relates to power devices. Specifically, the present invention relates to semiconductor power devices.

20

Description of the Related Art:

Techniques have been developed for producing W-band semiconductor power devices (e.g. 50 Ghz to 120 Ghz). For example Gunn and Impatt diode sources have been developed which produce $\frac{1}{4}$ watt of power. However, these sources are very expensive. Indium Phosphide High Electron Mobility Transistor (InP HEMT) amplifiers have been developed which produce 1/10 watt of power. However these devices range from \$10,000 to \$20,000 in cost. Lastly, technologies are being

developed which produce heat with high-frequency microwave beams. These technologies require power in the 100 KW to 1 MV range. However, devices implemented with these technologies (tubes) may cost millions of dollars each.

In general, devices implemented with conventional technologies do not generate affordable power in the W-band. In addition, the flexibility of conventional power systems, such as Gunn and Impatt diodes and InP HEMT amplifiers, is limited.

Thus, there is a need in the art for a cost effective high power W-band power system. That is, there is a need in the art for a W-band power system that can be inexpensively configured, to provide variable output power levels. Lastly, there is a need for a W-band power system that takes advantage of current semiconductor manufacturing technology to minimize costs.

The above-referenced related U.S. Patent Application Serial No. 10/010,140 filed 05/20/2002 by K.W. Brown *et al.*, and entitled MONOLITHIC MILLIMETER WAVE REFLECTOR ARRAY SYSTEM (Atty. Docket No. PD-01W176) addresses this need by providing a monolithic millimeter wave reflect array system. However, there is a further need for a transmissive mode implementation and for a system or method for providing an in-line amplifier using the array.

SUMMARY OF THE INVENTION

15

The need in the art is addressed by the amplifier of the present invention. In the illustrative embodiment, the amplifier includes a monolithic semiconductor substrate and an array disposed on said substrate for coherently receiving and retransmitting electromagnetic energy. In a specific embodiment, the array is implemented with a plurality of cells. Each of the cells includes a dual polarization antenna structure for receiving electromagnetic energy and an amplifier connected thereto.